

# Global Tropospheric Experiment Pacific Exploratory MissionWest A (GTE PEM West A) Langley ASDC Data Set Document



# **Summary**

This document provides information on data products obtained during the GTE Pacific Exploratory Mission-West A atmospheric science expedition conducted over the western Pacific during September and October 1991. The objective of the mission was to investigate the atmospheric chemistry of ozone and sulfur over the northwestern Pacific. Measurements were made primarily by investigators' instruments located on the NASA Ames Research Center DC-8 airborne laboratory. Also provided are a list of principal investigators, a brief summary of measurement techniques and a list of publications.

This document provides information for the following PEM West A data sets:

#### DC-8 Platform

gte\_pemtb\_p3mXX.zip:DC-8 Aircraft Data for flight XXgte\_pemwa\_jpg\_msn\_04.zip:Time series and altitude plots of

Time series and altitude plots of in situ measurements on DC-8

### **NIES Aircraft Platform**

gte\_pemwa\_ground\_pc.zip:

Measurements of  $O_3$ , CO, Hydrocarbons,  $SO_2$ , and navigational data aboard the NIES aircraft during an intercomparison flights with the DC-8 aircraft

# **Ground based Measurements**

**gte\_pemwa\_ground\_ak.zip:**O<sub>3</sub> concentration at Tsushima and Okinawa, Japan, and O<sub>3</sub> and CO concentrations at Oki. Japan

gte\_pemwa\_ground\_ja.zip: Measurements of NO at Oki, Japan

gte\_pemwa\_ground\_pr.zip:

High volume aerosols collection and analysis of major ions and trace

elements at Ken-Ting, Taiwan, Shemya, Alaska, Oaha, Hawaii, Midway Island, Okinawa, Japan, Hong Kong, and Cheju Island,

Korea.

Measurements of HCs, NO, NO $_{\rm x}$ , NO $_{\rm y}$ , SO $_{\rm 2}$ , HNO $_{\rm 3}$ , NO $_{\rm 3}$ , and SO $_{\rm 4}$  at

Lin An, Peoples Republic of China;

Measurements of NO NO<sub>2</sub> NO<sub>x</sub>, SO<sub>2</sub>, NO<sub>y</sub>, and O<sub>3</sub>, Black Carbon at

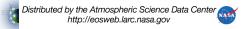
Lin An, Peoples Republic of China;

# **Acknowledgment**

gte\_pemwa\_ground\_ro.zip:

gte\_pemwa\_ground\_zh.zip:

The investigators involved in the PEM West A mission were funded by NASA. The funded investigators, their organization and their grant, agreement, or contract were:



Area	Investigator	Organization	Grant
Aircraft	A. Bandy	Drexel U	NAG-1-1224
	J. Bradshaw	GA Tech	NAG-1-1213
	E. Browell	NASA Langley	N/A
	G. Gregory	NASA Langley	N/A
	B. Heikes	U of Rhode Island	NAG-1-1222
	S. Rowland	U of California- Irvine	N/A
	G. Sachse	NASA Langley	N/A
	H. Singh	NASA Ames	N/A
	R. Talbot	U of New Hampshire	NAG-1-1233
Ground	R. Arimoto	U of Rhode Island	NAG-1-1225
	J. Prospero	U of Miami	NAG-1-1229
Modeling	J. Merrill	U of Rhode Island	NAG-1-1235
	D. Davis	Georgia Tech	NCC-1-148
	R. Newell	Mass Inst of Tech	NAG-1-1252
	S. Liu	NOAA Boulder	N/A

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# 1. Collection Overview

#### a. Collection Contents

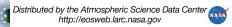
Aircraft data sets are available for each investigation for each flight. Airborne measurements were made at generally constant altitude (i.e. "survey" flights) over the North Pacific Ocean and between major sites and multi-altitude flights (i.e. "intensive" flights) occurred around the intensive sites and closer to Asia. Flight missions were conducted during PEM West A from September 16 through October 22, 1991. Section 4.b lists the flight. The duration, altitude range, ascent and descent rate, and flight path for each mission varied depending on mission objectives and environmental conditions. Further information about the measurement region and time frame may be found in the Journal of Geophysical Research, Vol. 101, No. D1, 1641-1653, 20 January 1996.

#### **Data Set Introduction**

This data set contains the DC-8 data submitted to the GTE data archive by the PEM West A investigators listed in Section 1.d. Included are the atmospheric chemistry, meteorological and navigational data recorded aboard the NASA DC-8 airborne laboratory. Japanese Cessna 404 aircraft flight 13 intercomparison data, ground site data, modeling products, trajectories and merged data sets are not contained in this archive. These data products can be found at the GTE data archive.

# **Summary of Parameters**

The atmospheric species and other parameters measured are listed in Hoell et al., [1996] Also listed for each are the name and affiliation of



the principal investigator.

#### b. Related Data Collections

PEM West A investigators have individually reported the results of their investigations in the Journal of Geophysical Research, Vol. 101, No. D1, January 20, 1996. Also see Atmospheric Chemistry of the East Asian Northwest Pacific Region, Akimoto, H. et al., in The Global Atmospheric-Biospheric Chemistry, edited by R. G. Prinn, pp. 71-82, Plenum Press, New York, 1994 for related discussions.

There are data sets available from the Langley ASDC for the 13 other GTE missions conducted from 1983 to 2001. See the GTE home page for a description of the available data.

## c. Title of Investigation

Global Tropospheric Experiment Pacific Exploratory Mission West A (PEM West A)

# d. Investigator Name and Title

If the person is known to be retired, deceased or no longer at the organization originally responsible for the investigation, it is noted and the contact information may be omitted. The contact information provided was current during the mission, but may no longer be current.

# **DC-8 Measurements Investigators**

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# e. Technical Contact(s)

The following persons have more specialized knowledge about the data in the data sets or in their field or general knowledge about the mission, its execution and the data sets.

Investigator or Knowledge Area	Investigator and Contact Information		
Non-methane hydrocarbon measurements aboard the DC-8	Donald Blake University of California-Irvine Department of chemistry Irvine CA 92717 Telephone: 714-856-4195 Fax: 714-725-2905 E-mail: drblake@uci.edu		
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PEM West A Project Manager	James M. Hoell, Jr. (retired) NASA Langley Research Center		
PEM West A Mission Meteorologist	Reginald Newell (deceased) Massachusetts Institute of Technology		
PEM West Associate Mission Meteorologist	Mark Shipham (no longer at NASA) NASA Langley Research Center		
PEM West A Expedition Manager	Richard J. Bendura (retired)  NASA Langley Research Center		
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PEM West Data Manager	Joseph W. Drewry (retired) NASA Langley Research Center		

# 2. APPLICATIONS AND DERIVATION

Potential usage and applications of the described data sets can be seen in the articles that comprise the Journal of Geophysical Research PEM West A Special Section (Vol.101, No. D1 January 20, 1996), the 1992 AGU Western Pacific Geophysics Meeting, the 1993 Conference of the International Global Atmospheric Chemistry (IGAC) Project, and the 1994 Conference of the International Global Atmospheric Chemistry (IGAC) Project.

## a. Calculated Variables

For convenience of the users, the calculated variables below are provided.

#### Mach Number, M:

$$\mathbf{M} = \sqrt{5 * \left( \frac{Q_c}{P_s} + 1 \right)^{2/3} - 1}$$

M = Mach NumberPs = Static PressureQc = Differential Pressure

# True Air Speed, TAS:

$$TAS(kts) = M*a = M*38.96695*\sqrt{T_s}$$

TAS = True Air Speed (knots)

T<sub>S</sub> = Static Air Temperature (°K)

M = Mach Number

a = Speed of Sound

# Static Air Temperature, Ts:

$$T_{s}(^{\circ}K) = \frac{T_{T}}{\left[1 + M^{2} * \left(\frac{\gamma - 1}{2}\right)\right]}$$

 $T_S$  = Static Air Temperature (°K)  $T_T$  = Total Air Temperature (°K)  $\gamma$  = 1.4, ratio of specific heat of air at constant pressure and volume

# Potential Temperature, $\theta$ :

$$\theta(^{\circ}\text{K}) = \text{T}_{\text{S}} * \left(\frac{1000}{\text{P}_{\text{S}}}\right)^{0.2857142}$$

 $\theta$  = Potential Temperature (°K)  $T_S$  = Static Air Temperature (°K) Ps = Static Pressure (mb)

#### Vapor Pressure, e(mb):

$$e_{water} = 10^{[23.5518 - (2937.4/T)]} * \textbf{T}^{(-4.9283)}$$

$$e_{ice} = 10^{[11.4816 - (2705.2/T)]} * T^{(-0.32286)}$$

T = Static Air Temperature (°K) for Saturation Vapor Pressure

T = Dew/Frost Point (°K) for Partial Pressure of Water Vapor

# Note:

StatTempDegK and ProjDP parameters recorded in the P-3B data set are substituted to calculate saturation vapor pressure and partial pressure of water vapor, respectively.

TSDEGC and ProjDP parameters recorded in the DC-8 data set are substituted to calculate saturation vapor pressure and partial pressure of water vapor, respectively. Also notice in the DC-8 data set there is a redundant static air temperature measurement, TSCALC, which is calculated by DADS. Although TSDEGC and TSCALC track closely they can diverge by ?0.8° at the low and high ends of the measurement range.

#### Specific Humidity, q:

$$q(g/kg) = \frac{0.622*10^3*e}{(P_s - 0.377e)}$$

$$q(ppmw) = \frac{0.622*10^6*e}{(P_s - 0.377e)}$$

### Relative Humidity, %:

w.r.t. water,  

$$RH_{water} = \frac{e_{water}}{e_{S_{water}}} *100$$

w.r.t. ice,  

$$RH_{ice} = \frac{e_{ice}}{e_{S_{ice}}} *100$$

# b. Graphs and Plots

Interested readers should see the Journal of Geophysical Research, Vol. 101, No. D1, January 20, 1996, and documents referenced therein, for plots and the results of analyses of data.

# 3. DATA DESCRIPTION AND ACCESS

#### a. Format

See the GTE Data Format Document.

## b. Data Organization

#### Granularity

A general description of data granularity as it applies to the IMS appears in the EOSDIS Glossary. Aircraft data sets are available for each investigation for each flight.

## c. Data Collection Status and Plans

All DC-8 aircraft data for the mission are contained in the archive. No additional data products relevant to the PEM West A archive are anticipated.

## d. Data Access

This data is available online through the GTE Data and Information table or on a CDROM via the LaRC ASDC and from the GTE data archive.

#### e. Data Archive Center

The Atmospheric Science Data Center at NASA's Langley Research Center.

#### **Contacts for Data Center or Data Access Information:**

User and Data Services Group Atmospheric Science Data Center MS 157D Langley Research Center Hampton, VA 23681 USA Phone: 757-864-8656

Fax: 757-864-8807
E-mail: <a href="mailto:support-asdc@earthdata.nasa.gov">support-asdc@earthdata.nasa.gov</a>
Internet: <a href="mailto:http://eosweb.larc.nasa.gov">http://eosweb.larc.nasa.gov</a>

# f. How to Cite the Data Collection

Publication of a portion(s) of the data archive should acknowledge the principal investigator(s) responsible for the data by referencing the appropriate manuscript in the Journal of Geophysical Research, Vol. 101, No. D1, January 20, 1996.

## 4. DATA CHARACTERISTICS

## a. Study Area

### **Spatial Coverage**

Flight missions were conducted during September and October, 1991. The duration, altitude range, ascent and descent rate, and flight path of each mission varied depending on mission objective and environmental (weather) conditions. The nominal air speed ranged from 480 knots (approximately 552 mph) at 12.6 km altitude to 240 knots (approximately 276 mph) at 0.34 km.

Data Set Name	Min Lat	Max Lat	Min Lon	Max Lon
Measurements aboard the	0.4 N	60.8 N	175.3W	176.2E
DC-8 aircraft				

#### **Spatial and Temporal Resolution**

Resolution varies for each measurement. See Hoell et al., [1996] for resolution of measurements made aboard aircraft.

#### **Grid Description**

No data gridding or binning of data to a geographic grid occurred during data processing.

# b. Temporal Coverage

Eighteen aircraft missions were conducted from September 16 to October 22, 1991.

Measurement Platform	Begin Date	End Date
DC-8 Aircraft	9/7/91	10/22/91

## c. Parameter or Variable

Not all of the parameters are in each data set granule. Also, the ranges vary between data sets and between granules within each data set. Species measured are given in Hoell et al., [1996].

#### **Parameter Description**

The variables measured are standard atmospheric chemical and meteorological species requiring no further elaboration here.

#### Unit of Measurement

The units of measure vary widely depending on species and measurement environment and are addressed in the individual papers for each investigation included in the Journal of Geophysical Research, Vol. 101, No. D1, January 20, 1996.

## **Parameter Source**

The instruments used in making the measurements are listed in Hoell et al., [1996].

#### **Parameter Range**

The ranges of data vary widely depending on species and measurement environment and are addressed in the individual papers for each investigation included in the Journal of Geophysical Research, Vol. 101, No.D1, January 20, 1996. The range (min/max) for each parameter can be found in the header record for each data file.

#### Sample Data Record

The GTE Data Format Document contains examples of each data set type.

#### d. Error Sources:

The sources of error vary widely depending on species and measurement environment and are addressed in the individual papers for each investigation included in the PEM West A special issue/section of the Journal of Geophysical Research, Vol.101, No. D1, January 20, 1996, and/or the papers referenced in that publication. For further details, contact the responsible principal investigators (see Section 1.d) and review the header for each data record. Instrument accuracy and precision, listed by parameter, can be found in Hoell et al., [1996].

#### 5. USAGE GUIDANCE

#### a. Known Problems with the Data

None reported for the current archive version. See the comment sections in the individual data files and the readme files submitted by the individual investigator.

#### b. Future Modifications and Plans

The data sets submitted to the ASDC are considered final and no further updates are planned. However, modifications will be considered if requested by the investigators or otherwise justified.

## 6. ACQUISITION MATERIALS AND METHODS

Details of data acquisition and materials are addressed in the Journal of Geophysical Research PEM West A Special Section (Vol.101, No. D1 January 20, 1996), the 1992 AGU Western Pacific Geophysics Meeting, the 1993 Conference of the International Global Atmospheric Chemistry (IGAC) Project, and the 1994 Conference of the International Global Atmospheric Chemistry (IGAC) Project.

#### 7. REFERENCES

AGU Western Pacific Geophysics Meeting, Hong Kong, 17-21 August 1992.

Conference of the International Global Atmospheric Chemistry (IGAC) Project, Eilat, Israel, 18-22 April, 1993.

Second Conference of the International Global Atmospheric Chemistry (IGAC) Project, Fuji-Yoshida, Japan, 5-9 September 1994.

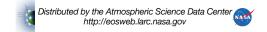
PEM West A Special Section, Journal of Geophysical Research, Vol.101, No. D1 January 20, 1996.

#### **GTE Bibliography**

Hoell, J. M., D. D. Davis, S. C. Liu, R. Newell, M. Shipman, H. Akimoto, R. J. McNeal, R. J. Bendura, and J. W. Drewry, Pacific Exploratory Mission-West A (PEM-West A): September-October 1991, J. Geophys. Res., Vol. 101, No. D1, 1641-1653, 20 January, 1996.

# 8. ACRONYMS

AGU - American Geophysical Union



ASDC - Atmospheric Science Data Center

**CMDL** - Climate Monitoring and Diagnostics Laboratory

**DADS** - Data Acquisition and Display System

**EOSDIS** - Earth Observing System Distributed Information System

**GTE** - Global Tropospheric Experiment

IGAC - International Global Atmospheric Chemistry

IMS - Information Management System

NASA - National Aeronautics and Space Administration

NIES - National Institute for Environment Science

NOAA - National Oceanic and Atmospheric Administration

PEM - Pacific Exploratory Mission

ProjDP - Project Dew Point

TSCALC - Static temperature, calculated by DADS

TSDEGC - Static temperature, measured directly, in Celsius

# 9. Document Information

• Creation Date: November 2003

Revision Date:Review Date:Identification:

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